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Short Communication

First record of *Cotylorhiza tuberculata* (Macri, 1778) from the Sea of Marmara

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ABSTRACT

Jellyfishes, which are one of the most important consumers in marine ecosystems, may have detrimental effects on fish stocks that have economic value. Therefore, identifying and monitoring jellyfish presence is important. We observed four individuals of symbiotic rhizostome scyphozoan *Cotylorhiza tuberculata* in the vicinity of the Princes' Islands Archipelago, in the Northeast Sea of Marmara, Turkey in September 2020. Although this species is a common member of gelatinous plankton in the Mediterranean Sea, the present study is the first record from the Sea of Marmara.

Keywords: *Cotylorhiza tuberculata*, rhizostomae, scyphomedusae, jellyfish, Sea of Marmara

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INTRODUCTION

Jellyfishes exhibit an important role in the marine food web as predators. Despite the fact that jellyfishes are low on the evolutionary tree, they generally feed high on marine food web, directly by eating fish eggs, larvae and juveniles and indirectly by competing with fishes for food (Mills, 2001; Purcell & Arai, 2001). In the blooming season they may even cause decreased depletion of fish stocks (Bilio & Niermann, 2004). Jellyfish blooms are possibly expedited by hypoxia, eutrophication, shipping, overfishing, bottom trawling, aquaculture, increased human activity on coastal regions, and global warming (Mills, 2001; Graham & Bayha, 2008; Boero, 2013). Jellyfish blooms are known to cause economic losses in fisheries and aquaculture by damaging nets, clogging the power plant cooling systems. Jellyfish blooms are also vectors of bacterial disease in aquaculture facilities and are responsible for harmful effects on tourism and human health (Ferguson et al., 2009; Nunes et al., 2015). Therefore, having knowledge of the exact distribution of jellyfish species is vital to draw up a strategy to prevent further damages.

In the Mediterranean Sea, there are six rhizostome jellyfish species. Among these jellyfishes, three of them are symbiotic, including *Cotylorhiza tuberculata* (Astorga, Ruiz, & Prieto, 2012). Symbiosis gives some advantages, such as nutrient support. This allows growth to be less dependent on the conditions of the surrounding environment for the zooxanthellae jellyfish. Furthermore, some fish species such as *Salpa salpa* and *Trachurus trachurus* use the tentacles of *C. tuberculata* as a habitat with the aim of protection and food supply (Öztürk et al., 2018).

C. tuberculata conclusively exhibits an intense top-down control on the food chain by selective feeding on diatoms, ciliates, larvae of some mollusks, and copepods (Pérez-Ruzafa et al., 2002). Individuals of this species are commonly found in a high quantity in the Aegean Sea (Balık, 1973; Kikinger, 1992), the Mediterranean Sea (Pérez-Ruzafa et al., 2002) and the Adriatic Sea (Benovic & Lucic, 2001). After being reported for the first time in Izmir Bay, in the Aegean Sea (Balık, 1973), this jellyfish has been recorded in different regions of the Aegean coast of Turkey (e.g. Gulsahin & Tarkan, 2013) and even in the vicinity of the Strait of Çanakkale (Alparslan, Doğu, & Özalp, 2011). The key

identifying characteristics of *C. tuberculata* are a flattened area throughout its margin and a cupola at the center of its bell which makes it look like a large fried egg from its dorsal side (see photos below). It also has lots of tentacles that have different lengths enclosing its eight lappets. Its numbers of tipped appendages with different colors ranging from bluish to purple are located between each of the oral arms. These oral arms are fragile, short and fused proximally and are typically eight in numbers in this species (Kikinger, 1992). The presence of unicellular symbiotic algae (i.e. zooxanthellae) give these colours to the jellyfishes. The medusae have sexual dimorphism, and instead of releasing individual sperm, it spawns spermatozeugmata. There is internal fertilization with embryogenesis which occurs inside the female oral arm canals. The life period of the medusae is generally about half a year due to decomposition of somatic tissue. The zooxanthellae-bearing medusae are potentially autotrophic and the only stage in the metagenetic cycle of the species that has no zooxanthellae is planula. The scyphistomae contain algal symbionts infection (Kikinger, 1992). Its size is generally up to 35-40 cm in diameter (Kramp, 1961). The present paper reports the first records of *C. tuberculata* from the Sea of Marmara.

The Sea of Marmara is an inland sea which constitutes a transition region between the Black Sea and the Mediterranean Sea through the Straits of Istanbul and Çanakkale. Due to the constant two-layered water system, the Sea of Marmara plays a pivotal role in biodiversity of the seas that it connects. In the last decade, the Sea of Marmara has been exposed to heavy changes that induce jellyfish bloom and mucilage generation. In the beginning of 1990, the ctenophore *Mnemiopsis leidyi* was introduced into the Sea of Marmara and it damaged all ecosystems drastically (Isinibilir, Tarkan, & Kideys, 2004). Since then, *Beroe ovata, Chrysaora hysoscella*, *Liriope tetraphylla*, *Aequorea vitrina and* other alien jellyfish species have been introduced to the region, respectively (İnanmaz, Bekbolet, & Kıdeyş, 2002; Isinibilir, Yilmaz, & Piraino, 2010; Yilmaz, Isinibilir, Vardar, & Dursun, 2017). Recent studies have proved that the numbers of jellyfishes have been growing in the Sea of Marmara lately (Isinibilir, Yilmaz, & Piraino, 2010; Yilmaz, Isinibilir, Vardar, & Dursun, 2017).

MATERIALS AND METHODS

On September 24th 2020, we observed and photographed four individuals of *C. tuberculata* (Figure 1) at about 1-2 m depth in the vicinity of the Büyükada, the Princes' Islands, in the Sea of Marmara, while scuba diving (Figure 2). The umbrella diameters of specimens were estimated as 30 cm and the sea surface temperature was 22°C.

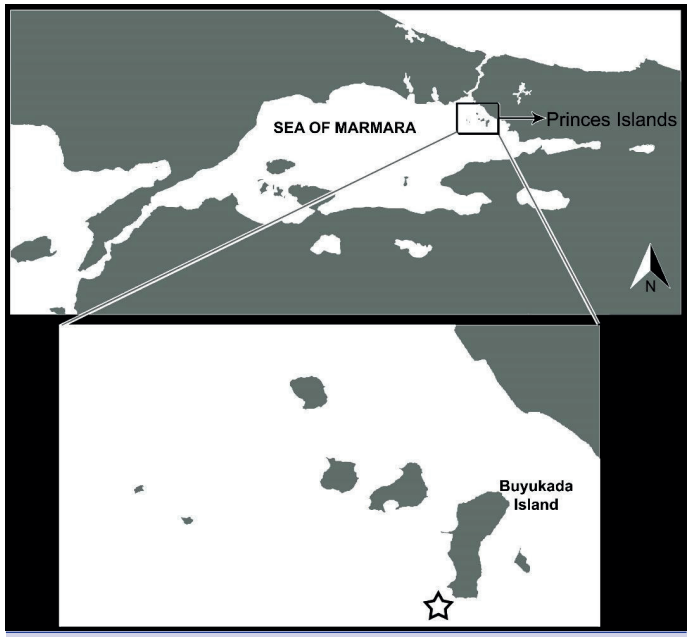

Figure 2. Sampling location of *Cotylorhiza tuberculata*.

RESULTS AND DISCUSSION

Cotylorhiza tuberculata was first reported in the Mediterranean Sea by Macrì in 1778. In recent decades, it has been occurring in exceedingly high abundance in some areas, particularly in the enclosed coastal areas and sub-basins of the Mediterranean Sea (Astorga, Ruiz, & Prieto, 2012). The main reason for the increasing number is warmer winter temperatures due to global warming (Prieto, Astorga, Navarro, & Ruiz, 2010). Although this species is a common member of gelatinous plankton in the Mediterranean Sea, the present study is the first record from the Sea of Marmara. The introduction of this species, which is already present in the

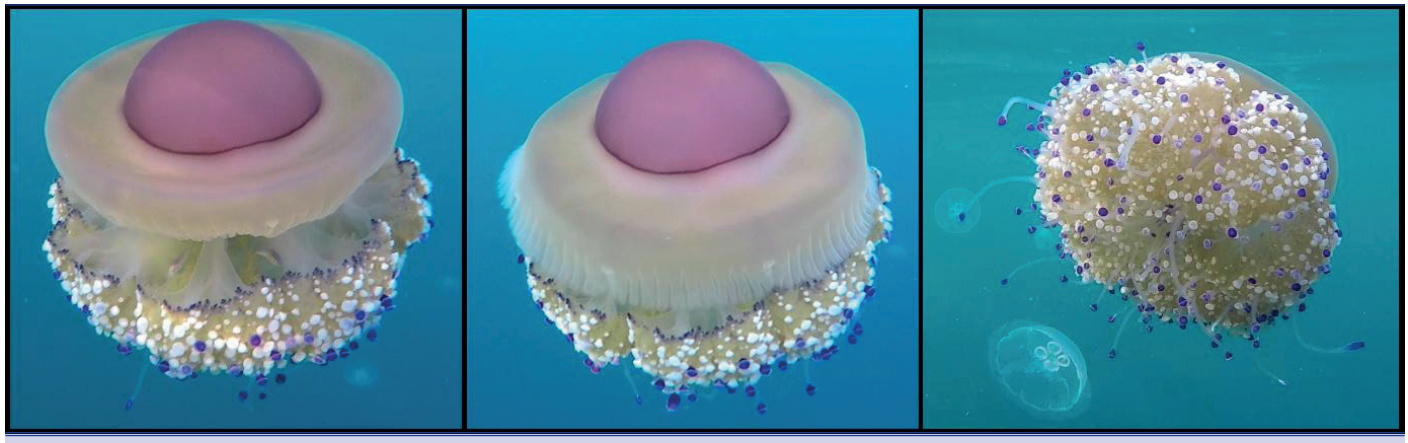

Figure 1. Live specimen of *Cotylorhiza tuberculata* in the Sea of Marmara (Photograph: Doğan Uğurlu).

Aegean Sea, presumably occurred either through the lower layer currents of the Çanakkale Strait or via the transportation of the ballast water from adjacent waters. There are two possible reasons why any polyps have not been found in the studies carried out in the Marmara Sea so far. It could be either due to *C. tuberculata* polyps' small size or their cryptic life habit even though the polyps persist longer than the more visible medusae (Prieto, Astorga, Navarro, & Ruiz, 2010). The presence of jellyfishes in great size in diameter could be explained by the fast size increase in *C. tuberculata*, which is more significant than the size increase in other rhizostome jellyfishes (Kikinger, 1992).

Jellyfishes are known as crucial consumers in all marine ecosystems, and thus they play an important role by reconstituting zooplankton communities (Mills, 2001). Their diet affects various fish species directly and indirectly (Brodeur, Suchman, Reese, Miller, & Daly, 2008). The Sea of Marmara is determined as a eutrophic sea (Tüfekçi, Balkis, Beken, Ediger, & Mantikci, 2010). High zooplankton abundance allows for a fast growth rate and large individuals of *Cotylorhiza tuberculata* (Kikinger, 1992). Moreover, eutrophic conditions in the Sea of Marmara may also lead to the occurrence of medusae in great sizes. Fast temperature increases in waters of the Marmara Sea have been occurring in the last several decades (Turan & Gürlek, 2016). Since *C. tuberculata* is a species that easily blooms in mild winters and long summers (Ruiz, Prieto, & Astorga, 2012), rising sea water temperature could precipitate its bloom in the Sea of Marmara. It has been reported in the studies conducted in the Sea of Marmara that some jellyfishes caused a shift in the temporal regime between jellyfish-dominated systems and crustacean-dominated systems, have caused the depletion of zooplankton, and have ultimately collapsed commercially important fish stocks (Yılmaz, 2015; Yılmaz & İşinibilir, 2016). *Cotylorhiza tuberculata* consume the microplanktonic food effectively until late autumn, when the degradation begins to occur because of the decreased photosynthetic process by reduced daylight period. Therefore, sub-umbrellar muscles weaken and decreased mesoglea flexibility leads to a reduction in the umbrellar pulsations thus reducing the food capture capacity of oral arms (Kikinger, 1992). In any *C. tuberculata* bloom event in the Sea of Marmara, we may observe a similar diet pattern which causes a reduction in the zooplankton community. As a consequence of increased jellyfish populations, fisheries and economies might be affected worldwide (Richardson, Bakun, Hays, & Gibbons, 2009). The Sea of Marmara is the second most important fisheries ground for Turkey (Yılmaz, Akay, & Gümüş, 2008). Therefore, any increasing effects on jellyfish populations could cause detrimental impacts on fisheries (Yılmaz & İşinibilir, 2016). In conclusion, monitoring the abundance and distribution of *C. tuberculata* in the Marmara Sea, which is considered to be a biological corridor or transition region between the Mediterranean and the Black Sea, is vital to understand better the changes it may cause in the pelagic food web.

Conflicts of interest: The authors have no conflicts of interest to declare.

Ethics committee approval: The authors declare that this study does not include any experiments with human or animal subjects.

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